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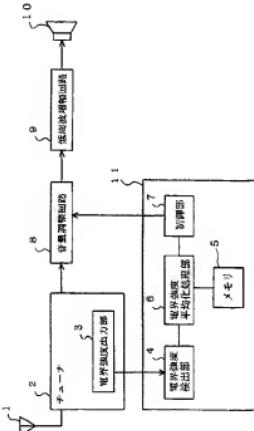
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## (54)【発明の名称】 AMラジオ受信装置およびそのAGC特性補正方法

## (57)【要約】

【課題】 AMラジオ受信装置において、電界強度が低下したときの希望信号成分の低下を防ぐため、ノイズの少ない間は希望信号のレベルが一定になるよう補正を行い、また一時的な電界変動には応答しないとする。

【解決手段】 受信したAMラジオ放送信号の電界強度を検出し、検出した電界強度の一定期間毎の平均値を演算するとともに、平均化した電界強度に対して音声出力の補正量を決め、その補正量に応じて音声出力を変化させる。



## 【特許請求の範囲】

【請求項1】受信したAMラジオ放送信号の電界強度を検出する電界強度検出手段と、検出した電界強度の一定期間毎の平均値を演算する電界強度平均化手段、および平均化した電界強度情報に対する音声出力の補正量を決め、その補正量に応じて音声出力を変化させる制御手段を備えたことを特徴とするAMラジオ受信装置。

【請求項2】請求項1において、上記制御手段は、選局操作時には、電界強度検出手段の検出した電界強度に応じて音声出力を制御することを特徴とするAMラジオ受信装置。

【請求項3】請求項1において、上記制御手段としてDSPを用いたことを特徴とするAMラジオ受信装置。

【請求項4】受信したAMラジオ放送信号の電界強度が弱くなるに従って検波出力ゲインを低下させノイズの増加を防ぐようなAGC特性を持たせたAMラジオ受信装置のAGC特性補正方法において、一定期間毎に上記受信信号の電界強度の平均値を演算し、平均化した電界強度情報に対する音声出力の補正量を決定すると共に、上記補正量に応じて音声出力を変化させ上記AGC特性を補正するようにしたことを特徴とするAMラジオ受信装置のAGC特性補正方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】この発明は、車載用等のAMラジオ受信装置において、特に弱電界信号受信時におけるAGC特性の改善に関するものである。

## 【0002】

【従来の技術】従来の車載用ラジオ受信装置では、走行に伴って受信電界強度が変化するため、電界強度が低下したときには、受信機のS/N特性が悪化して受信信号中の雑音レベルが増加する。そこで、このような電界強度が弱いときの耳障りなノイズを低減するために、電界強度が弱くなるとチューナで検波出力のゲインを落とし、ノイズの増加を防ぐようなAGC特性を持たせている。

【0003】また、例えば実開平3-120139号公報に示されるように、電界強度の低下に伴い、徐々に検波出力のゲインが下がるのを防止するため、電界強度信号で直接、電子ボリュームを補正するものもあるが、ノイズによる一時的な電界変動にも反応し、音のふらつきの原因となっている。

## 【0004】

【発明が解決しようとする課題】この発明は電界強度が低下したときの希望信号成分の低下を防ぐため、ノイズの少ない間は希望信号のレベルが一定になるよう補正を行い、また一時的な電界変動には応答しないようにしたAMラジオ受信装置及びそのAGC特性補正方法を提供することを目的とする。

## 【0005】

【課題を解決するための手段】上記課題を達成するためには、この発明のAMラジオ受信装置は、受信したAMラジオ放送信号の電界強度を検出する電界強度検出手段と、検出した電界強度の一定期間毎の平均値を計算する電界強度平均化手段、および平均化した電界強度情報に対する音声出力の補正量を決め、その補正量に応じて音声出力を変化させる制御手段を備えている。また、制御手段は、選局操作時には、電界強度検出手段の検出した電界強度に応じて音声出力を制御する。さらに、制御手段としてDSPを用いる。

【0006】また、受信したAMラジオ放送信号の電界強度が弱くなるに従って検波出力ゲインを低下させノイズの増加を防ぐようなAGC特性を持たせたAMラジオ受信装置のAGC特性補正方法において、一定期間毎に上記受信信号の電界強度の平均値を演算し、平均化した電界強度情報に対して音声出力の補正量を決定すると共に、上記補正量に応じて音声出力を変化させ上記AGC特性を補正する。

## 【0007】

【発明の実施の形態】実施の形態1、図1はこの発明の一実施形態を示す車載用AMラジオ受信機のブロック図である。図において、1は受信アンテナ、2はAMラジオ放送電波を受信し音声信号を出力するチューナ部、3は受信電界強度に比例した直流電圧(Sメータ電圧)を感知する電界強度出力部、4は前記Sメータ電圧を一定周期でサンプリングし、電界強度を検知する電界強度検出手部、5はサンプリングしたSメータ電圧データを逐次記憶するメモリ部、6はメモリ部に記憶されたSメータ電圧データの一定期間毎の相加平均を算出し平均電界強度情報S\_vを出力する電界強度平均化処理部、7は平均電界強度情報S\_vに対応して音量及び音質の補正量を決定する制御部、8は制御部7の制御信号によって音声信号の音量及び音質を調整する音量調整部、9は音声信号を增幅する低周波増幅回路、10はスピーカーである。なお、電界強度検出手部4、メモリ部5、電界強度平均化処理部6及び制御部7はマイクロコンピュータ1内に含まれる。

【0008】アンテナ1で受信している電波の電界強度が十分高いときには、チューナ2から出力されるノイズが少ないため、チューナ2で検波された音声信号は音量調整回路8に入力され、希望の音量、音質に調整され、低周波増幅回路9に入力される。低周波増幅回路9で增幅された音声信号が、スピーカー10から出力される。

【0009】一方、電界強度がやや低下しチューナ2のAGC特性によりチューナからの音声出力が低下していく状態においては、電界強度検出手部4でサンプリングした電界強度を、電界強度平均化処理部6で相加平均して平均電界強度情報S\_vを得、制御部7で平均電界強度情報S\_vに基づいて音声出力の補正量を決定し、この補正量に応じて音量調整回路8を制御し音量を上げ希望信号

の低下を抑制する。

【0010】さらに電界強度が低下してきた場合には、チューナからの音声出力のノイズ成分が増加するため、音量調整回路8を制御し音量を下げるとともに、低域、高域の音質を下げる方向に調整することにより、耳障りなノイズを軽減できる。

【0011】図2はマイクロコンピュータ11による制御動作を説明するためのフローチャートで、ステップS1においてチューナ2内の電界強度出力部3から出されたSメータ電圧を一定間隔、例えば1000ms毎にサンプリングしてマイコン11内の電界強度検出部4に取り込む。次にステップS2において、サンプリングされたSメータ電圧を逐次メモリ部5に記憶する。そしてステップS3において、一定期間(例えばサンプリング16回相当分)経過したかどうかを判定し、満足した場合には、ステップS4においてS2で記憶されたSメータ電圧の相加平均値を演算し、一定時間毎の平均電界強度情報をSvを得る。さらにステップS5において、S4で得られた電界強度情報をSvに対する音量・音質の補正量を制御部7に格納されたテーブルから算出する。この場合の補正量としては、例えば電界1dBμV毎に音量0.5dB単位で変化させる。そして、算出された補正量に応じて音量・音質の補正が必要な場合にはステップS6においてS5で求めた補正量に対応して音量調整回路8を制御する。

【0012】このような制御を行うことにより、アンテナ1で受信している電波の電界強度が十分高いときには、音量調整回路8はユーザーの希望の音量、音質調整を行なう一方、電界強度がやや低下していく状態では、電界強度検出部4で検出した電界強度の平均値に応じて、音量調整回路8を制御し希望信号の低下が抑制できる。すなわち、図3のAGC特性図に示すように、まだノイズ成分Nがそれほど増えていないのにSのようになにチューナー出力が低下する状態においても、図3のSのよう安定した出力を等価的に得ることができる。

【0013】しかも、メモリ部5に記憶された電界強度情報を利用し、一定時間毎の電界強度の平均値を基に制御を行なっているので、電界強度の判定に時定数を持たることができ、ノイズによる一時的な電界変動などには反応せず、音のふらつきを防ぐことができる。

【0014】なお、他局切替時すなわち遅延操作を行い受信局が変わった場合には、電界が大きく急変する可能性があるので、この場合には図2のS7に示すように、電界強度平均化処理部6による平均化処理をバスクして電界強度の平均化処理によらず、制御部7はステップS4で検出した電界強度に応じて所定の音量及び音質の補正量だけ音量調整回路8の補正を行う。

【0015】また、上記音量及び音質の補正にDSP(Digital Signal Processor)を用いた場合には、複雑な回路を追加することなく実現でき、電界強度に応じ

て細かく補正量を設定するなど細かい制御が可能となる。

### 【0016】

【発明の効果】以上のように、この発明のAMラジオ受信装置は、受信したAMラジオ放送信号の電界強度を検出する電界強度検出手段と、検出した電界強度の一定期間毎の平均値を演算する電界強度平均化手段、および平均化した電界強度に対して音声出力の補正量を決め、その補正量に応じて音声出力を変化させる制御手段を備えることにより、チューナのAGC特性によりノイズが増加する前に希望信号が低下することを防ぐことが可能となり、AGC特性を改善することができる。この改善により、電界強度が低下しても希望信号が低下することなく、ノイズの増加に伴い急峻に音声レベルを下げるこにより、より聞きやすい特性を作ることができる。その際、一定期間の電界強度の平均値で制御することにより、一時的な電界強度の低下への反応をなくし、より聽きやすい特性を得ることができる。

【0017】また、制御手段は、遅延操作時には、電界強度検出手段の検出した電界強度に応じて音声出力を制御するので、他局に切替えた場合には、電界強度平均化手段による平均化処理をバスクして聴感上達成感のないようにすることができる。さらに、制御手段としてDSPを用いることにより、複雑な回路を追加することなく細かい制御が可能となる。

【0018】また、受信したAMラジオ放送信号の電界強度が弱くなるに従って検波出力のゲインを低下させノイズの増加を防ぐようなAGC特性を持たせたAMラジオ受信装置のAGC特性補正方法において、一定期間毎に上記受信信号の電界強度の平均値を演算し、平均化した電界強度に対する音声出力の補正量を決定すると共に、上記補正量に応じて音声出力を変化させ上記AGC特性を補正することにより、電界強度がやや低下しチューナのAGC特性によりチューナからの音声出力が低下していく状態でも、電界強度に応じて音量を上げ希望信号の低下を抑制できる。

### 【図面の簡単な説明】

【図1】この発明の実施形態1を示す車載用AMラジオ受信装置のブロック図。

【図2】この発明の動作を説明するフローチャート。

【図3】この発明による効果を説明するためのAGC特性図。

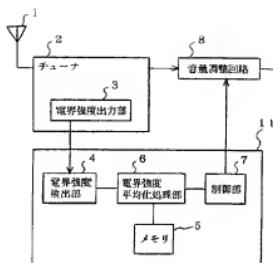
### 【符号の説明】

- 1 アンテナ
- 2 チューナ
- 3 電界強度出力部
- 4 電界強度検出部
- 5 メモリ部
- 6 電界強度平均化処理部
- 7 制御部

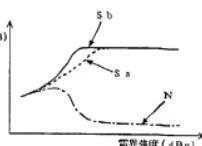
8 音量調整回路  
9 低周波増幅回路

10 スピーカー  
11 マイクロコンピュータ

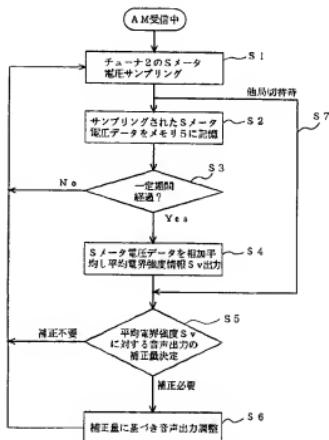
【図1】



【図3】



【図2】



## PATENT ABSTRACTS OF JAPAN

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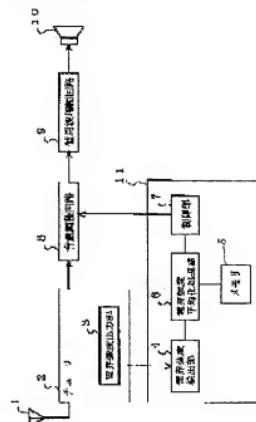
(72)Inventor : MIKI TOMOYUKI

## (54) AM RADIO RECEIVER AND ITS AGC CHARACTERISTIC CORRECTION METHOD

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an AM radio receiver that conducts correction so as to make a level of a desired signal constant and does not respond to temporary electric field fluctuations while a noise is small in order to prevent the desired signal component from being deteriorated when the electric field strength is deteriorated.

**SOLUTION:** The receiver detects an electric field strength of a received AM radio broadcast signal, calculates a mean value of the detected electric field strength for each prescribed period, decides a correction amount of sound output with respect to the averaged electric field strength and changes the sound output depending on the correction amount.



## LEGAL STATUS

[Date of request for examination]

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CLAIMS

## [Claim(s)]

[Claim 1] AM radio receiving set characterized by having the control means to which a field strength detection means to detect the field strength of received AM radio broadcasting signal, a field strength equalization means to calculate the average for every fixed period of the detected field strength, and the amount of amendments of the voice output to the equalized field strength information are decided, and a voice output is changed according to the amount of amendments.

[Claim 2] It is AM radio receiving set [claim 3] characterized by controlling a voice output according to the field strength to which the field strength detection means detected the above-mentioned control means in claim 1 at the time of channel selection actuation. AM radio receiving set characterized by using DSP as the above-mentioned control means in claim 1.

[Claim 4] In the AGC property amendment approach of AM radio receiving set which gave an AGC property which detection output gain is reduced and prevents the increment in a noise as the field strength of received AM radio broadcasting signal becomes weak Calculate the average of the field strength of the above-mentioned input signal for every fixed period, and while determining the amount of amendments of the voice output to the equalized field strength information The AGC property amendment approach of AM radio receiving set characterized by changing a voice output according to the above-mentioned amount of amendments, and amending the above-mentioned AGC property.

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## DETAILED DESCRIPTION

### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention] This invention is set to AM radio receiving sets for mount etc., and relates to an improvement of the AGC property at the time of weak-electric-current community signal reception especially.

#### [0002]

[Description of the Prior Art] In the conventional radio receiving set for mount, since received field strength changes with transit, when field strength falls, the S/N property of a receiver gets worse and the noise level in an input signal increases. Then, in order to reduce a jarring noise when such field strength is weak, if field strength becomes weak, the gain of a detection output will be dropped on a tuner, and an AGC property which prevents the increment in a noise is given.

[0003] Moreover, although there are some which amend electronic BORIUMU directly by the field strength signal in order to prevent that the gain of a detection output falls gradually with the fall of field strength, as shown, for example in JP,3-120139,U, it reacts also to temporary electric-field fluctuation by the noise, and has become the cause of wandering of a sound.

#### [0004]

[Problem(s) to be Solved by the Invention] In order that this invention may prevent the fall of the signal component of choice when field strength falling, it aims at offering AM radio receiving set amends so that the level of the signal of choice may become fixed while there are few noises, and it was made not to answer temporary electric field fluctuation, and its AGC property amendment approach.

#### [0005]

[Means for Solving the Problem] In order to attain the above-mentioned technical problem, AM radio receiving set of this invention determined a field strength detection means detect the field strength of received AM radio broadcasting signal, a field strength equalization means calculate the average for every fixed period of the detected field strength, and the amount of amendments of the voice output to the equalized field strength information, and is equipped with the control means to which a voice output is changed according to that amount of amendments. Moreover, a control means controls a voice output according to the field strength which the field strength detection means detected at the time of channel selection actuation. Furthermore, DSP is used as a control means.

[0006] Moreover, it sets to the AGC property amendment approach of AM radio receiving set which gave an AGC property which detection output gain is reduced and prevents the increment in a noise as the field strength of received AM radio broadcasting signal becomes weak. The average of the field strength of the above-mentioned input signal is calculated for every fixed period, while determining the amount of amendments of a voice output to the equalized field strength information, a voice output is changed according to the above-mentioned amount of amendments, and the above-mentioned AGC property is amended.

#### [0007]

[Embodiment of the Invention] Gestalt 1. drawing 1 of operation is the block diagram of AM radio set for mount in which 1 operation gestalt of this invention is shown. The tuner section which 1 receives a receiving antenna, and 2 receives AM radio broadcasting electric wave, and outputs a sound signal in drawing. The field strength output section which outputs the direct current voltage (S meter electrical potential difference) to which 3 is proportional to received field strength, The field strength detecting element which 4 samples said S meter electrical potential difference a fixed period, and detects field strength. The memory section which memorizes serially the S meter electrical-potential-difference data which 5 sampled, The field strength equalization processing section which 6 calculates the arithmetical mean for every fixed period of the S meter electrical-potential-difference data memorized by the memory section 5, and outputs the average field strength information Sv. The control section as which 7 determines sound volume and the amount of amendments of tone

quality corresponding to the average field strength information  $S_v$ , the sound-volume controller to which 8 adjusts the sound volume and tone quality of a sound signal with the control signal of a control section 7, the low frequency amplifying circuit where 9 amplifies a sound signal, and 10 are loudspeakers. In addition, the field strength detecting element 4, the memory section 5, the field strength equalization processing section 6, and a control section 7 are contained in a microcomputer 11.

[0008] Since there are few noises outputted from a tuner 2 when the field strength of the electric wave received with the antenna 1 is sufficiently high, the sound signal detected with the tuner 2 is inputted into the sound-volume equalization circuit 8, is adjusted to the sound volume of hope, and tone quality, and is inputted into the low frequency amplifying circuit 9. The sound signal amplified in the low frequency amplifying circuit 9 is outputted from loudspeaker 10.

[0009] In the condition that field strength falls a little and the voice output from a tuner declines with the AGC property of a tuner 2, the arithmetical mean of the field strength sampled by the field-strength detecting element 4 is carried out in the field-strength equalization processing section 6, the average field-strength information  $S_v$  is acquired, the amount of amendments of the voice output based on the average field-strength information  $S_v$  determines by the control section 7, a sound-volume equalization circuit 8 controls according to this amount of amendments, on the other hand, sound volume raises, and the fall of the signal of choice controls.

[0010] While controlling the sound-volume equalization circuit 8 and lowering sound volume since the noise component of the voice output from a tuner increases when field strength has furthermore fallen, a jarring noise is mitigable by adjusting in low-pass and the direction which lowers the tone quality of a high region.

[0011] Drawing 2 is a flow chart for explaining the control action by the microcomputer 11, samples the S meter electrical potential difference outputted from the field strength output section 3 in a tuner 2 in step S1 100ms of fixed spacing, every [ for example, ], and incorporates it to the field strength detecting element 4 in a microcomputer 11. Next, in step S2, the sampled S meter electrical potential difference is serially memorized in the memory section 5. And in step S3, when it judged and passes [ whether fixed period (equivalent for for example, sampling 16 time) progress was carried out, and ], the arithmetic mean of the S meter electrical potential difference memorized by S2 in step S4 is calculated, and the average field strength information  $S_v$  for every fixed time amount is acquired. It computes from the table in which the amount of amendments of the sound volume and tone quality over the field strength information  $S_v$  acquired by S4 was furthermore stored by the control section 7 in step S5. For example, it is made to change in sound volume of 0.5dB for every electric-field  $dBmV$  as an amount of amendments in this case. And according to the computed amount of amendments, when sound volume and tone quality need to be amended, the sound-volume equalization circuit 8 is controlled corresponding to the amount of amendments calculated by S5 in step S6.

[0012] When the field strength of the electric wave received with the antenna 1 by performing such control is sufficiently high, while the sound-volume equalization circuit 7 performs the sound volume of hope of a user, and tone control, in the condition that field strength falls a little, according to the average of the field strength detected by the field strength detecting element 4, it controls the sound-volume equalization circuit 8, and can control the fall of the signal of choice. That is, as shown in the AGC property Fig. of drawing 3, also in the condition that a tuner output falls to noise component N having not increased so much yet like Sa, a stable output like Sb of drawing 3 can be obtained equivalent.

[0013] And since the field strength information memorized by the memory section 5 is used and it is controlling based on the average of the field strength for every fixed period, a time constant can be given to the judgment of field strength, and it cannot react to temporary electric-field fluctuation by the noise, but wandering of a sound can be prevented.

[0014] In addition, since electric field may change suddenly greatly when it carries out at the time of an other station change, i.e., channel selection actuation, and a receiving station changes, as shown in S7 of drawing 2 in this case, the equalization processing by the field strength equalization processing section 6 is passed, and it is not based on equalization processing of field strength, but only predetermined sound volume and the amount of amendments of tone quality amend the voice equalization circuit 8 according to the field strength which detected the control section 7 at step S14.

[0015] Moreover, when DSP (Digital Signal Processor) is used for amendment of the above-mentioned sound volume and tone quality, it can realize without adding a complicated circuit and fine control, such as setting up the amount of amendments finely according to field strength, is attained.

[0016]

[Effect of the Invention] As mentioned above, AM radio receiving set of this invention A field strength detection means to detect the field strength of received AM radio broadcasting signal. By deciding the amount of amendments of a voice output to a field strength equalization means to calculate the average for every fixed

period of the detected field strength, and the equalized field strength, and having the control means to which a voice output is changed according to the amount of amendments. Before a noise increases with the AGC property of tuner, it becomes possible to prevent the signal of choice falling, and an AGC property can be improved. The property which is easier to hear it can be made by lowering voice level steeply with the increment in a noise by this improvement, without the signal of choice falling, even if field strength falls. In that case, by controlling by the average of the field strength of a fixed period, the reaction to the fall of temporary field strength can be lost, and the property which is easier to hear it can be acquired.

[0017] Moreover, at the time of channel selection actuation, since a control means controls a voice output according to the field strength which the field strength detection means detected, when it changes to an other station, it passes the equalization processing by the field strength equalization means, and there can be no audibility top sense of incongruity. Furthermore, fine control is attained by using DSP as a control means, without adding a complicated circuit.

[0018] Moreover, it sets to the AGC property amendment approach of AM radio receiving set which gave an AGC property which the gain of a detection output is reduced and prevents the increment in a noise as the field strength of received AM radio broadcasting signal becomes weak. Calculate the average of the field strength of the above-mentioned input signal for every fixed period, and while determining the amount of amendments of the voice output to the equalized field strength By changing a voice output according to the above-mentioned amount of amendments, and amending the above-mentioned AGC property, according to field strength, sound volume is raised also in the condition that field strength falls a little and the voice output from a tuner declines with the AGC property of a tuner, and the fall of the signal of choice can be controlled in it.

[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The block diagram of AM radio receiving set for mount in which the operation gestalt 1 of this invention is shown.

[Drawing 2] The flow chart explaining actuation of this invention.

[Drawing 3] AGC property drawing for explaining the effectiveness by this invention.

[Description of Notations]

- 1 Antenna
- 2 Tuner
- 3 Field Strength Output Section
- 4 Field Strength Detecting Element
- 5 Memory Section
- 6 Field Strength Equalization Processing Section
- 7 Control Section
- 8 Sound-Volume Equalization Circuit
- 9 Low Frequency Amplifying Circuit
- 10 Loudspeaker
- 11 Microcomputer

[Translation done.]